

BRIEF MEDITATION TRAINING CAN IMPROVE PERCEIVED STRESS AND NEGATIVE MOOD

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ABSTRACT

Objectives: Test a brief, non-sectarian program of meditation training for effects on perceived stress and negative emotion. Determine effects of practice frequency and test the moderating effects of neuroticism (emotional lability) on treatment outcome.

Design and Setting: The study used a single-group, open-label, pre-test post-test design conducted in the setting of a university medical center.

Participants: Healthy adults (N = 200) interested in learning meditation for stress-reduction were enrolled. One hundred thirty-three (76% females) completed at least 1 follow-up visit and were included in data analyses. Intervention: Participants learned a simple mantra-based meditation technique in 4, 1-hour small-group meetings, with instructions to practice for 15-20 minutes twice daily. Instruction was based on a psychophysiological model of meditation practice and its expected effects on stress.

Outcome Measures: Baseline and monthly follow-up measures of: Profile of Mood States; Perceived Stress Scale; State-Trait Anxiety Inventory; and Brief Symptom Inventory. Practice frequency was indexed by monthly retrospective ratings. Neuroticism (NEO PI-R) was evaluated as a potential moderator of treatment effects.

Results: All four outcome measures improved significantly after instruction, with reductions from baseline that ranged from 14% (STAI-S) to 36% (BSI). More frequent practice was associated with better outcome. Higher baseline neuroticism scores were associated with greater improvement.

Conclusions: Preliminary evidence suggests that even brief instruction in a simple meditation technique can improve negative mood and perceived stress in healthy adults, which could yield long-term health benefits. Frequency of practice does affect outcome. Those most likely to experience negative emotions may benefit the most from the intervention.

Meditation training has become a popular intervention for the prevention and treatment of stress-related diseases and for the management of stress that often accompanies serious medical conditions. Published research studies describe the application of meditation training as primary or adjunctive treatment for high blood pressure and other coronary disease risk factors,¹⁻³ chronic pain,⁴⁻⁶ and cancer,⁷⁻¹¹ as well as for stress management in high stress

occupations.¹²⁻¹⁵ In the research literature, the two most commonly studied meditation training programs are Transcendental Meditation (TM) and the Mindfulness-Based Stress Reduction (MBSR) program of the Center for Mindfulness at the University of Massachusetts Medical School, North Worcester, Massachusetts. These two proprietary programs have been distributed widely and are available in many locations throughout this and other countries. However, the TM and MBSR programs share several characteristics that may limit their use in the general population.

Both programs are based on traditional practices of Asian religions. The TM technique has its origins in the religious practices of India and includes a formal initiation conducted in Sanskrit. Initiates receive secret Sanskrit mantras, traditionally used to invoke Hindu deities, to use as the focus of meditation practice. MBSR is based on traditional Buddhist meditation practices and incorporates concepts and material from Buddhist philosophical writings in the class presentations.¹⁶ Such religious foundations may make these programs unacceptable to individuals who practice other religions or no religion and may prevent their adoption by publicly funded programs and public schools. In addition, both TM and MBSR programs require considerable commitments of time and money to complete training. The TM program requires 10 hours of lectures and instruction in 7 separate steps.¹⁷ The standard MBSR program requires about 30 hours to complete, with 8 weekly classes and a full-day retreat. These programs typically charge several hundred to several thousand dollars for initial training. Clearly, the time requirements and expense would be barriers for many individuals, and the high cost itself could limit their use in many situations.

These limitations can be overcome. Meditation training programs have been developed without specific religious associations. Furthermore, there is no empirical evidence that lengthy instruction is necessary for effective meditation training. Indeed, several individuals have suggested that non-sectarian forms of meditation can be taught in 1 or a few brief meetings, or can even be learned from a book.¹⁸⁻²⁰ These simpler programs have been shown to be effective treatments for stress and stress-related disease.¹⁸⁻¹⁹

The authors (JDL and JES) developed a simple, brief, non-sectarian meditation training program for use in a clinical trial of meditation and relaxation as non-pharmacological treatments for high blood pressure. This development effort sought to create a “generic” alternative to the popular proprietary systems, one which had the potential for time-efficient and cost-effective instruction. During enrollment for this hypertension treatment study, a second sample of 200 non-hypertensive adults was enrolled in an “open-label” study of meditation training for stress reduction. This study, called the “Calm Your Stress Study,” was designed to provide preliminary evidence of the effectiveness of the training program for the reduction of subjective stress and negative emotion, in a general population of self-referred adults who were interested in learning meditation for stress management. The study had 3 objectives: to evaluate the potential changes in measures of perceived stress and negative

emotion after individuals began to practice this generic meditation technique; to determine whether the frequency of meditation practice affected outcome during follow-up; and to test whether an individual's initial level neuroticism could explain variability in outcome following meditation training. The latter 2 objectives were intended to open new lines of meditation research. Current recommendations for practice frequency and duration have little or no evidence base, without empirical data linking practice to outcome. The current literature offers no explanation for why meditation training yields different outcomes among individuals, although the identification of characteristics related to treatment success could be used to target the individuals most likely to benefit from instruction. The results of this pre-experimental study were intended to inform the design of additional controlled trials, if they were warranted by initial results.

METHODS

Study Design

The Calm Your Stress Study used a single-group, pretest-posttest design²¹ that included a pre-intervention baseline assessment and 3 follow-up assessments at monthly intervals following the start of meditation practice. Although this pre-experimental design lacked controls for indirect effects of participation, the open-label approach simulated the effects of training in naturalistic settings in a large and varied population. The planned assessments of the effects of practice frequency and tests of specific hypotheses related to the moderation of outcome effects by personality and affect variables served to strengthen the overall design. To control subject-experimenter artifacts and biases, instruction and data collection were conducted by different individuals, in different locations, and at different times.

Participants

A sample of 200 adult men and women was recruited from among employees, students, patients, and visitors of Duke University and Duke University Medical Center through campus newsletters, brochures, and handbills. Advertisements sought volunteers who were interested in learning a simple meditation technique for the purposes of stress reduction. Lenient eligibility criteria were used to encourage a heterogeneous sample. Participants were required to be at least 18 years of age and able to speak, understand, read, and write English, which was necessary for understanding instruction and completing assessments. Potential volunteers who had active psychiatric disease or used psychoactive medications, who were currently participating in other formal stress management programs, or who planned to move from the study area or travel extensively during the course of participation were excluded from the study. Participants who completed the study received \$40 as compensation for the time required for study assessments.

Measures

Four different instruments assessed subjective stress and negative mood before and after training. Although the domains of these instruments were expected to overlap, each provided a different perspective on the concept of subjective stress. When instruments contained multiple scales, the overall summary score was used for hypothesis testing, to control the type 1 error that could arise from multiple independent tests.

General negative mood was assessed using the brief version of the Profile of Mood States (POMS; Multi-Health Systems, Inc, North Tonawanda, NY), which contains 30 adjectives that describe feelings (eg, friendly, tense, grouchy, angry). Participants rated each item on a 5-point scale to describe their moods during the past week, including the current day. Scores were calculated for 6 different moods or affective states: Tension-Anxiety, Depression-Dejection, Anger-Hostility, Vigor-Activity, Fatigue-Inertia, and Confusion-Bewilderment. Total Mood Disturbance (TMD), the sum of these scales (with Vigor-Activity subtracted), was used as the summary score for general negative mood. The POMS has good internal consistency and reliability and has been widely used in research.²²

The Perceived Stress Scale (PSS) was used to provide a global measure of perceived stress in daily life. The PSS is a 14-item instrument designed to measure the degree to which common situations are appraised as stressful.²³ The items ask about feelings and thoughts during the past month and how often the respondent felt a certain way in a specific situation. Responses range from “never” to “very often” on a 5-point scale. The PSS has adequate reliability and validity.²³

Anxiety was measured with the State-Trait Anxiety Inventory (STAI; CCP, Inc, Mountain View, Calif), a widely used measure with well-established validity and reliability.²⁴ The state version STAI-S was used to assess changes in general anxiety over time. This instrument consists of 20 items containing words descriptive of anxiety that are rated on a 4-point scale and asks participants to rate their feelings at that moment.

The Brief Symptom Inventory (BSI; National Computer Systems, Inc, Minneapolis, Minn)²⁵ derived from the SCL-90-R,²⁶ assessed symptoms of psychological distress. The BSI is a 53-item scale of self-reported psychological symptoms experienced during the previous 7 days. Nine symptom dimensions are measured using items rated on a 5-point scale from “not at all” to “extremely.” The General Severity Index (GSI) is a weighted score based on all items that combines information on the number of symptoms experienced and their severity. The reliability and validity of the BSI are well-documented.²⁷

Study participants completed retrospective assessments of meditation practice frequency at each follow-up visit. Frequency of practice was reported using a 7-point category scale that included the following choices: “twice a day every day”; “twice a day most days”; “at least once

a day every day”; “once a day every day”; “once a day most days”; “several times a week”; and “never.”

Neuroticism was assessed using the Revised NEO Personality Inventory (NEO PI-R; Psychological Assessment Resources, Inc, Lutz, Fla),²⁸ a personality inventory that operationalizes the 5-factor model of normal personality. The NEO PI-R contains 240 descriptive statements that are completed by self-ratings on a 5-point scale and typically takes 20 to 30 minutes to complete. Validity and reliability have been established. The neuroticism domain (N) contrasts emotional stability versus lability. Scores reflect the general tendency to experience negative emotions such as “fear, sadness, embarrassment, anger, guilt, and disgust.” (28, p. 14) The N domain includes sub-scores or facets for specific emotions comprising anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability to stress, which were examined in exploratory analyses.

Intervention

The meditation technique was similar to techniques described by Benson,¹⁸ Carrington,¹⁹ and Wilson.²⁰ Participants selected for themselves a sound, word, or brief phrase (“mantra”) to be used as the focus of meditation. They sat with eyes closed and began practice with a brief (less than 1 minute) period of relaxed abdominal respiration, then repeated their mantra silently and continuously for 15 to 20 minutes. Mantra repetition was not linked to the breath. Participants were instructed to allow the mantra to repeat at its own natural pace and simply to return to the mantra repetition whenever they noticed that other thoughts, sensations, or feelings had come into consciousness and distracted attention from the repetition of the mantra. Each practice ended with 1 to 2 minutes of quiet rest before other activities were resumed. The emphasis of the instruction was effortless repetition of the mantra and recognition and control of intrusive thoughts. Participants were instructed that twice-daily practice for the 3 months of the study would provide them with a full experience of the potential of the technique (cf Wilson²⁰).

Participants learned the meditation technique in the first of 4, 1-hour meetings and began twice-daily practice the following day. The remaining classes served to reinforce the instructions and provide information and guidance to support the development of a regular practice regimen. Questions were answered, and common problems were presented and discussed. Meditation was presented as a cognitive exercise that enhanced the experience of the quiet mind and taught recognition and control of intrusive thoughts. Participants were also given a psychophysiological rationale for the stress-reducing effects of meditation. At the final meeting, the instructor addressed common problems that arise during independent practice and discussed the benefits and experiences that have been reported by others who continued regular meditation practice.

After the final meeting, study participants continued to practice on their own. They were told to contact instructors if they had questions or concerns about the technique or their practice. No further formal contact was maintained during follow-up, however.

Procedures

Interested volunteers made initial contact and completed preliminary screening by telephone, then scheduled an appointment for completion of informed consent procedures. Participants provided detailed background and medical history information, and completed the NEO PI-R questionnaire.

The outcome instruments (POMS, PSS, STAI State, and BSI) were completed at a baseline visit prior to training, and participants were then scheduled for meditation training. Participants were taught in small groups. The 4, 1-hour group meetings were held at lunchtime or after work on a Monday/Wednesday or Tuesday/Thursday schedule over 2 weeks. When participants missed a meeting, a make-up session was scheduled, if possible. Those participants who attended at least 3 of the 4 meetings were considered to have completed training.

Follow-up visits were scheduled 4, 8, and 12 weeks after the date of the first class. Participants returned to the laboratory and completed the 4 outcome instruments. Although participants were encouraged to call investigators with questions or concerns about practice, such contacts were rare. Study personnel did not contact participants except to schedule the follow-up visits. Study participants were encouraged to complete the follow-up visits, even if they had stopped meditating. Repeated e-mail and telephone contacts were attempted as necessary to complete follow-up. Those individuals who refused to reply to repeated contacts or who asked not to be contacted again were considered "dropouts" from the study. The study concluded with the 12-week follow-up visit.

Data Analysis

Standard scoring procedures were used for all self-report instruments. Summary scores were used for hypothesis testing, when instruments contained sub-scales, to reduce the number of statistical tests and control type 1 error; however, sub-scale scores were used for exploratory purposes. Hypothesis tests were conducted using procedures for mixed-models analysis of variance or covariance to accommodate the repeated measurements over time. Mixed models (Proc MIXED, SAS v. 8; SAS Institute, Inc, Cary, NC) allowed the inclusion of all available data and did not delete participants with incomplete data. Mixed models also permitted inclusion of time-varying covariates and between-subject variables when appropriate. Given the single-group design, hypothesis tests focused on the main effects of time (baseline and follow-up) and interactions of the time factor with between-subjects factors. When main effects and interactions were significant, contrasts of baseline and each of the 3 follow-up visits were

conducted to locate changes temporally. Comparisons among follow-up time points were also conducted to explore the stability of changes over time. The criterion $P < .05$ was used to declare statistical significance for all tests.

RESULTS

Participant Disposition and Characteristics

Two hundred people expressed interest in participating in the study and scheduled appointments for orientation, informed consent, and baseline data collection. The disposition of these participants is shown in detail in Figure 1.

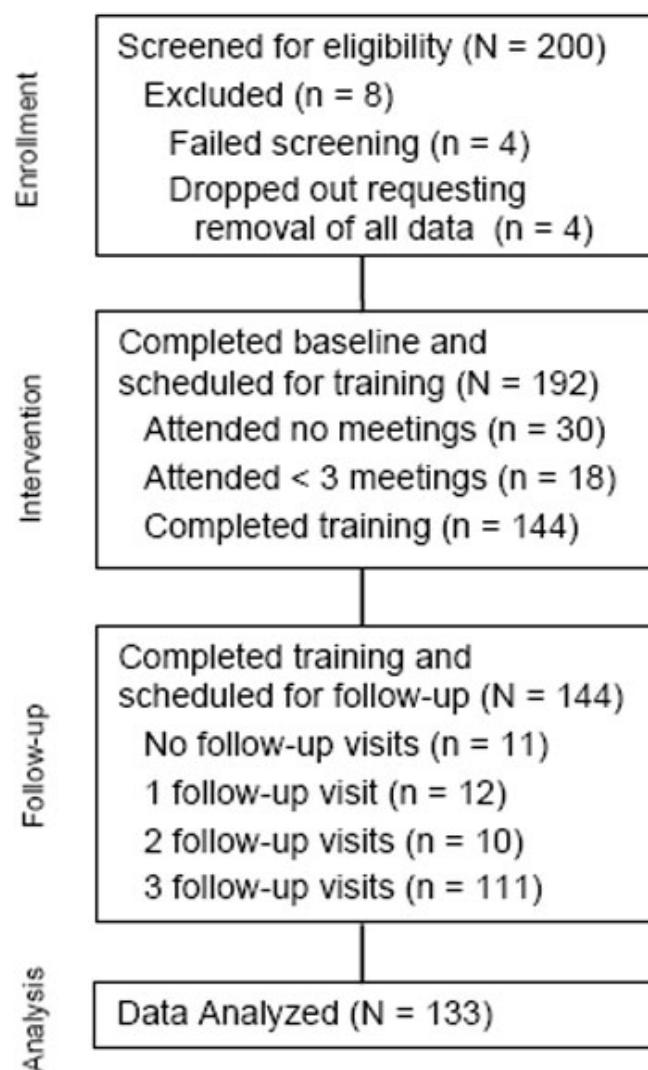


FIGURE 1 Disposition of Study Participants

Baseline data were available for 192, because 4 participants failed to meet study inclusion criteria and 4 withdrew requesting removal of their study data. Thirty participants who completed baseline never arranged to take the classes despite repeated contacts. Of the 144 participants who completed training, 133 completed at least one follow-up visit. The average age (\pm SD) of this sample was 38.0 ± 13.5 years. The group was 76% female. Seventy-four percent of participants were white, 17% were African-American, and the remainder were Asian, Hispanic, or Native American. Most (73%) were currently employed, 9% were retired, and the remainder included unemployed individuals and students. Half of the group had 12 to 16 years of education, and the other half had more than 16 years.

Effects of Meditation Training

Meditation training led to highly significant reductions ($P < .0001$) in all four measures of stress and negative emotion (Table 1). Improvements were noted at the first follow-up visit 4 weeks after participants began meditation practice and remained stable until the final follow-up at 12 weeks. The planned contrasts of baseline vs each follow-up visit demonstrated significant reductions for all four outcome measures at all 3 visits (all $P < .0001$). Post-hoc comparisons found no differences among the 3 follow-up visits for any measure, indicating stability over time. Post-treatment reductions were 30% of baseline levels for POMS total mood disturbance, 23% for the PSS, 14% for STAI, and 36% for the GSI on the BSI.

Table 1. Changes in perceived stress and negative mood following meditation training.

Outcome Measure	Pre-training		Post-training Follow-up			Time Effect
	Baseline	4 Weeks	8 Weeks	12 Weeks		
Profile of Mood States Total Mood Disturbance	24.7 ± 1.3^a	12.2 ± 1.5^b	11.9 ± 1.6^b	11.6 ± 1.6^b	$F(3,363) = 41.48$ $P < .0001$	
Perceived Stress Scale	28.1 ± 0.6^a	22.0 ± 0.7^b	22.0 ± 0.7^b	21.0 ± 0.7^b	$F(3,362) = 54.77$ $P < .0001$	
State Trait Anxiety Inventory State Scale	39.6 ± 0.8^a	34.4 ± 0.9^b	34.3 ± 0.9^b	33.8 ± 0.9^b	$F(3,362) = 17.97$ $P < .0001$	
Brief Symptom Inventory General Severity Index	0.70 ± 0.03^a	0.46 ± 0.03^b	0.47 ± 0.04^b	0.42 ± 0.04^b	$F(3,359) = 41.17$ $P < .0001$	

*For each outcome measure, mean values differ significantly from the baseline mean value but are not different from each other ($P < .05$).

Effects of Practice on Outcome

The relationship between practice frequency and outcome was tested using retrospective self-reports of the frequency of meditation practice collected at follow-up visits. Inspection of the 364 completed reports revealed a bimodal distribution of responses on the 7-point categorical

scale, with an extreme low point at category 4 ("once a day, every day," 1.4% of responses). Given the shape of the distribution, the 7 categories were dichotomized into high (once a day or more frequently) and low (less than once a day) practice frequency categories. This division had face validity, representing low practice frequency as less than daily practice. In addition, this division yielded similar proportions for the two categories, 48% high vs 52% low.

Because practice frequency could vary over time during follow-up, practice category was included as a time-varying covariate in a re-analysis of treatment outcome data. Outcome values during follow-up were converted to change scores by subtracting baseline values, a necessary step because practice frequency data were not available at baseline. The hypothesized effects of practice frequency on outcome change were evaluated by tests of the main effect of practice category and the interaction of practice category with visit, which would indicate a changing influence of practice frequency during follow-up.

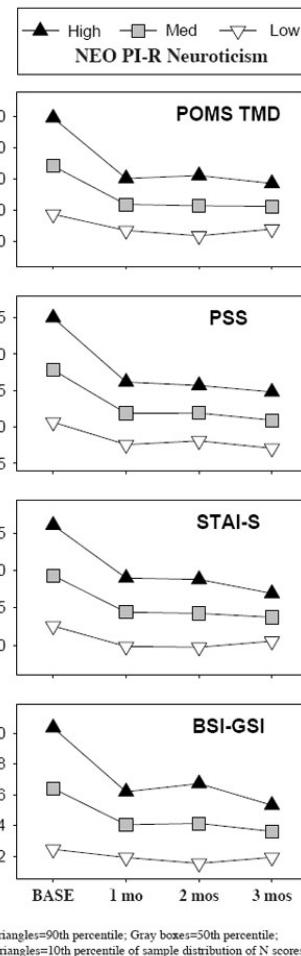
Table 2. Average Changes in Outcome Measures From Baseline to Follow-up for the Dichotomous Categories of Reported Daily Meditation Practice.

		Self-reported Frequency of Meditation Practice		
Outcome Measure		One or more times daily	Less than once a day	Difference p-value
Profile of Mood States Total Mood Disturbance		-15.1 ± 1.73	-10.4 ± 1.7	< .02
Perceived Stress Scale		-7.7 ± 0.8	-4.9 ± 0.7	< .001
State Trait Anxiety Inventory Scale		-7.0 ± 1.1	-4.6 ± 1.1	< .05
Brief Symptom Inventory General Severity Index		-0.27 ± 0.04	-0.23 ± 0.03	> .25

None of the practice-category by visit interaction effects was significant (all $P > .3$), but the main effect of practice frequency was significant for POMS total mood disturbance, PSS, and STAI (Table 2). Practice frequency did not affect BSI GSI change scores significantly ($P > .25$). More frequent practice was consistently associated with greater reductions in scores for perceived stress and negative emotion and an overall better outcome. Improvements in these 3 measures were more than 50% greater when a participant practiced at least once a day, compared to less frequent practice.

Neuroticism as a Moderator of Meditation Effects

In order to test the moderating effects of initial level of neuroticism on responses to training, N scores from the NEO PI-R were included as a fixed covariate in re-analyses of outcome data. Moderation was assessed by the test of the interaction of N and visit, which revealed whether the trait affected the changes in stress or mood score over time.



Black triangles=90th percentile; Gray boxes=50th percentile;
White triangles=10th percentile of sample distribution of N scores.

FIGURE 2 Moderation of Treatment Outcome by Baseline Level of NEO PI-R Neuroticism

NEO PI-R N scores were distributed normally in the study sample. The mean score (\pm SD) was 89.2 ± 23.8 and the median was 87 with an interquartile range of 33. This mean corresponds roughly to the 70th percentile on adult norms for men and women.²⁸ N scores did not differ significantly between the sexes by t -test ($P > .30$). The N by visit interactions were significant for all 4 outcome measures (all $P < .0001$). These interactions were graphed using parameters of the regression models to calculate estimates over time for N-scores at the 90th, 50th, and 10th percentiles of the sample distribution (Figure 2). The graphs indicate that higher neuroticism scores were associated with higher baseline scores for each of the mood and stress measures and with greater reductions in negative mood and stress after training in all 4 measures.

Discussion

Meditation practices such as TM and MBSR have been employed for stress reduction in a variety of settings, although the length and cost of training and the association of these programs with Eastern religions may limit their broad acceptance. The results of this open-label study demonstrate that even brief training in a simple non-sectarian meditation practice can be associated with improvements in subjective stress and negative emotions in a general sample of adults interested in learning meditation as a stress-reduction technique. The group demonstrated highly significant reductions in all 4 outcome measures of perceived stress and negative emotion. For 3 of the 4 outcome measures, reductions of 20% to 40% from baseline scores were observed. These beneficial changes were apparent at the initial follow-up 1 month after training began and were maintained until the end of the study at 3 months.

The observed effects cover a broad range of negative moods and perceptions. TMD from the POMS is a summary score comprised by anger, confusion, depression, fatigue, and tension, with vigor scores subtracted. Post-hoc examination of these separate scales revealed significant improvements in all 6, although changes were larger for the 4 negative mood scales than the 2 scales that assess the physical symptoms of fatigue and vigor (data not reported). PSS scores include both the number of common stressors experienced in everyday life and the negative impact that these stressors have. Items on the STAI assess the level of anxiety at the moment of administration. The GSI of the BSI combines 9 separate symptom dimensions: somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychotism. Post-hoc exploration of these dimensions found that all were significantly reduced after treatment, with all but one (somatization) dropping by about 40% from baseline levels. Thus, improvements following meditation training appear to be widespread in the domain of stress and negative emotion.

The importance of regular meditation practice has often been asserted, despite the lack of empirical evidence. Our results confirm that more frequent meditation practice is associated with better outcome. Differences between “at least once a day” practice and “less than once a

“day” practice were statistically significant in 3 of 4 outcome measures (POMS, PSS, and STAI), with a similar trend in the fourth (BSI). The beneficial effects of more frequent practice persisted through the 3 months of follow-up. Similar practice effects have been reported in several recent studies of MBSR for stress reduction,^{10, 12, 29} although the majority of meditation studies have neglected to test the effects of practice frequency. The covariations of practice frequency and treatment outcome reported here do not establish a “dose response” effect for practice or determine a minimal level of practice that provides useful results, because individual levels of practice were self-selected; however, these results are consistent with a causal effect of practice frequency on outcome and should stimulate further research on the dose-response question. Certainly, we need to understand how practice frequency affects outcome if we want to develop effective and efficient training programs for the general public. Traditional guidelines for the frequency and duration of meditation practice will be strengthened by empirical evidence to support them.

Finally, this study demonstrated that individual characteristics may affect the outcome of a meditation intervention. In these data, participants who scored higher on the NEO PI-R domain of neuroticism demonstrated greater improvements following meditation training. Graphs of the interactions suggest that the higher-N participants reported higher initial levels of negative emotion and perceived stress prior to training and subsequently converged towards the lower-N participants. These results complement those of a recent study that found that initial trait anxiety scores were correlated with increased autonomic relaxation indexed by heart rate variability when participants learned Zen meditation.³⁰ It may not seem surprising that participants who start with higher stress scores show greater improvement; however it is reassuring that these individuals are not resistant to the potential benefits of meditation practice, especially when they appear to have the most to gain. Future investigations may clarify the characteristics of responsive individuals so that treatments could be targeted more effectively.

These results are preliminary, given the open-label nature of the study and the lack of experimental controls for possible indirect effects associated with participation in the training program. But the results do suggest that simple, brief, non-sectarian programs of meditation training may offer benefits to adults in the general population interested in stress reduction. Such programs may have advantages over more established programs in many situations, especially where the length and cost of training or ties to Eastern religions are barriers to participation. Simpler programs could be made available at lower cost, which could be a further advantage in publicly funded settings such as schools or community programs. Although the established programs have offered the opportunity for many individuals to learn meditation and receive the benefits of regular practice, there may be significant value in the exploration of less intensive, non-sectarian meditation training programs that can bring these results to a larger population.

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